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Improved Process for Epitaxial Deposition of Silicon on Prediffused Substrates

It is frequently desirable to fabricate integrated circuits in a silicon layer epitaxially deposited on a silicon wafer in which a heavily doped sublayer pattern has been diffused. Either of two methods has been used for the epitaxial deposition of silicon. In one method the silicon source is silane (SiH_4); in the other method, silicon tetrachloride ($SiCl_4$) is the silicon source. The silane reaction, nonreversible decomposition at 1000° C, produces a silicon layer with a sharp junction. This junction is desirable, as out diffusion is minimized and the original sublayer pattern is undisturbed. However, depletion of the reaction gases results in a silicon layer of varying thickness and resistivity. The silicon chloride reaction, reduction with hydrogen at 1150° C, produces a silicon layer that is uniform in both thickness and resistivity. This reaction is reversible, however, releasing and redepositing a sufficient amount of the diffused sublayer doping to obliterate the pattern.

A new process which has been developed will uniformly deposit silicon expitaxially on prediffused substrates without affecting the sublayer pattern. In this process, approximately 2 microns of silicon are first deposited at 1000° C from a silane source. The temperature of the substrate is then raised to 1150° C and the rest of the required silicon layer is deposited from a silicon tetrachloride source. In this manner, the sublayer diffusion pattern is protected from the silicon tetrachloride reaction.

Note:

Details may be obtained from:

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Patent status:

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code GP, Washington, D.C. 20546.

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Category 03